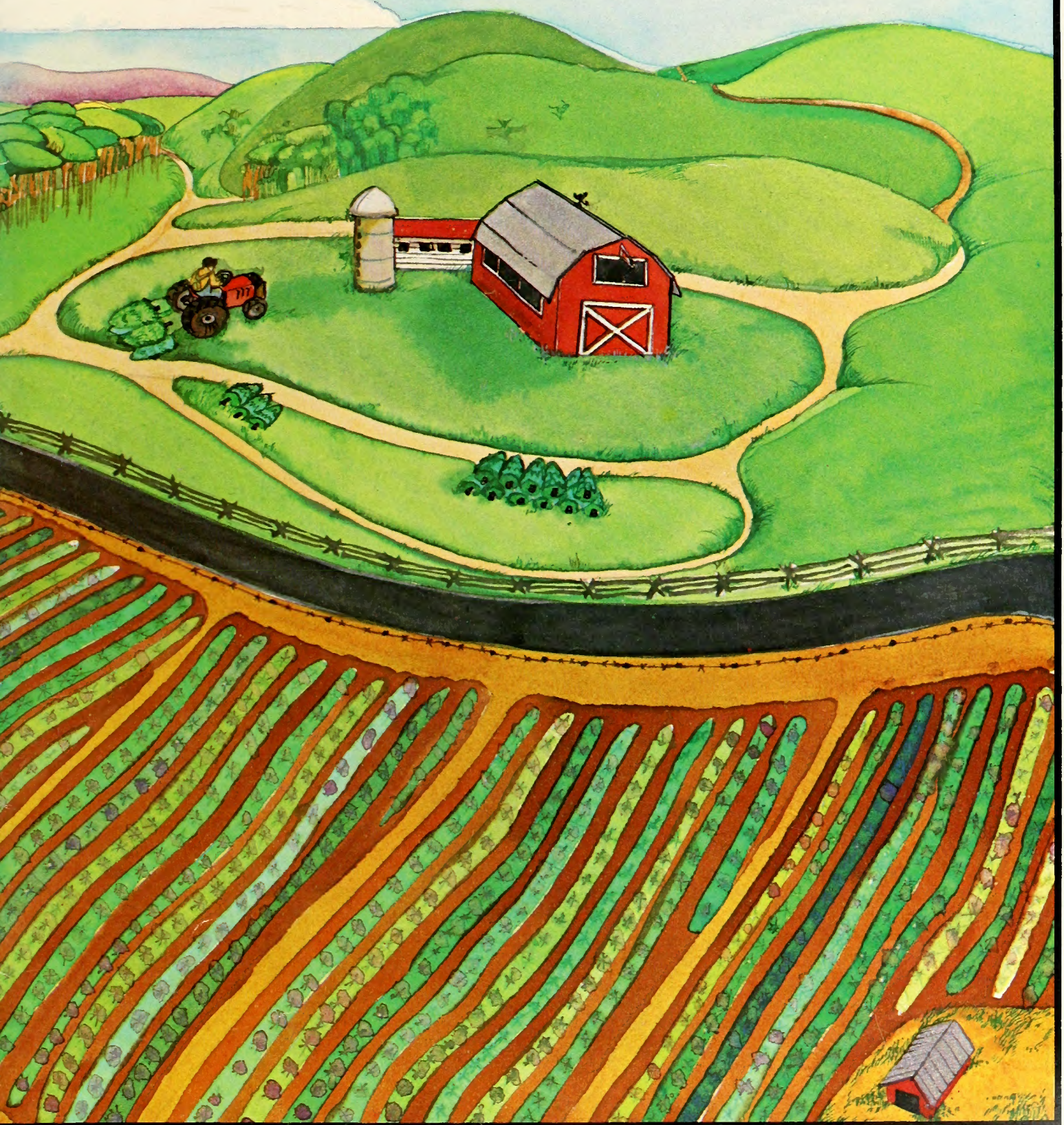


A15
30:95
1979

JAN 4 1980

Raising Christmas Trees in North Carolina

NORTH CAROLINA STATE LIBRARY
RALEIGH

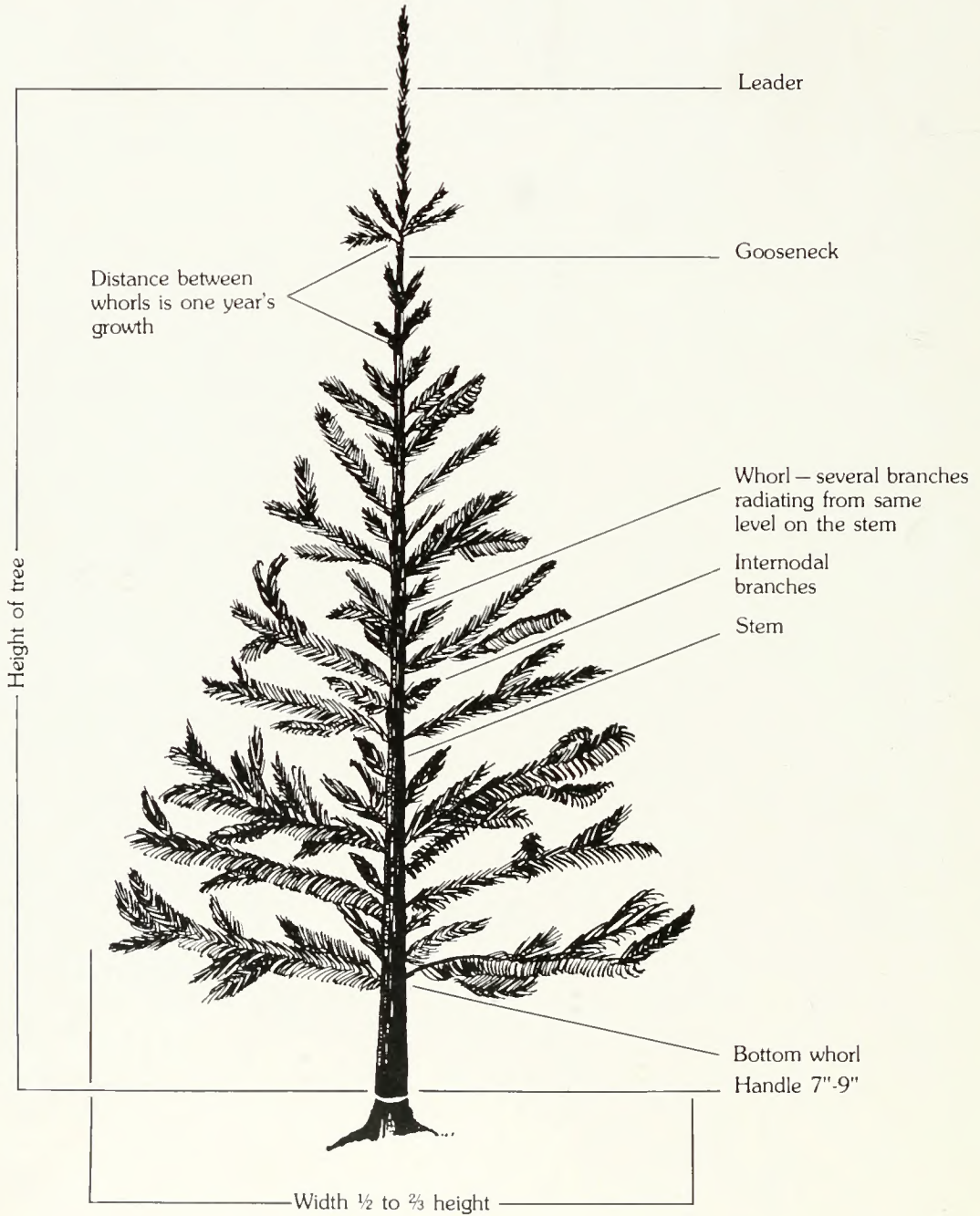


13
6095
779

Cover Illustration

Plantation layout which includes direction of rows, spacing, location of roads and culverts within the plantation. Equipment turnaround and storage areas for grading and loading are also shown. A plantation layout, such as shown here, is very desirable in the Christmas tree business.

Christmas Tree Terminology



Growing Christmas Trees in North Carolina

Acknowledgements

The cooperation and assistance of the Departments of Agronomy, Economics, Entomology, Plant Pathology, and Horticultural Science, North Carolina State University, in the preparation of this publication are gratefully acknowledged. Special appreciation is expressed to Dr. T. Ewald Maki, Schenck Professor, School of Forest Resources, for reviewing the manuscript and suggesting improvements. Appreciation is also expressed to the Department of Natural and Economic Resources, Division of Forest Resources, the Soil Conservation Service, and to the Southeastern Forest Experiment Station, U. S. Forest Service, for reviewing the manuscript and for certain photographs and drawings.

Special thanks are also due our co-workers in Extension Forestry and the School of Forest Resources of North Carolina State University and to Miss H. Dale Powell, temporary employee, for the drawings used in this publication, to Krista Brickey for the cover illustration and Robbin Gourley for the book design and layout.

Contents

CHARACTERISTICS OF SOME EVERGREEN TREES.....	1
Fraser fir.....	1
Balsam fir.....	1
Douglas-fir.....	1
White pine.....	1
Virginia pine.....	2
Redcedar.....	2
Spruce species.....	2
White fir.....	2
ESTABLISHING A CHRISTMAS TREE PLANTATION.....	3
Site Selection and Planning.....	3
Selecting the Species.....	3
Site Preparation.....	4
Selecting the Planting Stock.....	5
Growing your Own Planting Stock.....	5
Outplanting the Trees.....	5
NECESSARY CULTURAL PRACTICES.....	6
Protection Against Insects and Mites.....	6
Protection Against Diseases.....	9
Protection Against Animals.....	10
Fertilizing.....	10
Shaping and Shearing.....	10
Weeds, Grass and Woody-Plant Control.....	12
Mechanical.....	12
Chemical.....	12
HARVESTING.....	12
MARKETING.....	13
KEEPING YOUR RECORDS.....	13
ASSISTANCE AVAILABLE.....	14
CONCLUSIONS AND SUMMARY.....	14
APPENDIX.....	14

Prepared by Fred E. Whitfield, Extension Forest Management (Retired), and Division of Forest Resources, N. C. Department of Natural and Economic Resources.

Published by

THE NORTH CAROLINA AGRICULTURAL EXTENSION SERVICE

North Carolina State University at Raleigh, North Carolina Agricultural and Technical State University at Greensboro, and the U. S. Department of Agriculture, Cooperating. State University Station, Raleigh, N. C., T. C. Blalock, Director. Distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. The North Carolina Agricultural Extension Service offers its programs to all eligible persons regardless of race, color, or national origin, and is an equal opportunity employer.

Introduction

This publication provides basic information that may help you increase income from growing Christmas trees. It attempts to cover most problems that you may encounter in such a venture.

Before undertaking growing Christmas trees as a crop, several aspects of the business must be carefully considered.

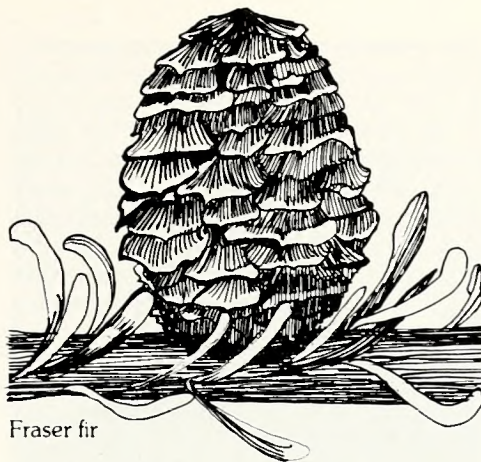
First, Christmas tree production requires land of suitable quality and adequate area. Also, it requires sizable amounts of labor and capital. Periodically, hired labor and material are sure to be needed for several years. Thus you will need to start with enough reserves to cover the costs incurred during the development stage until income is realized from the sale of trees.

Much of the normal cultural work such as mowing, shearing, and pest control must be done punctually in season when the weather is hot. In contrast, harvesting is done late in autumn or early winter, sometimes in bitter, cold weather. In brief, the profitable production of Christmas trees requires intensive care with precise timing from planting to harvest. *It is not a get-rich-quick scheme*, but rather a long-term (5-10 years) business venture requiring a multitude of business skills.

Unless they secure professional advice right at the start, newcomers are advised to "grow into" rather than "buy into" the Christmas tree business. Efficient production of a few quality trees is better than mass production of poor quality trees. The price the consumer is willing to pay for a tree at the retail lot is not based on where the tree grows but simply on quality and price. At present there are no foreseeable limits on the number of quality trees North Carolina growers may sell. While ample quantities of low-quality trees are always available, there have never been enough quality trees to supply the demand. North Carolina growers live within 500 miles of approximately half the nation's population, so fresh trees can be delivered overnight to compete in a regional market.

Characteristics of Some Evergreen Trees

Before deciding which tree species to plant, you must consider several points. You should study characteristics of the different trees to determine which species will grow into high-quality trees on land you have available and in the climatic zone in which you will operate. Then you should determine whether there are natural advantages over competing Christmas trees. For example, trees not native in the state may grow well in North Carolina, but such species are being grown widely elsewhere in great numbers at low cost. On the other hand, the native Fraser fir is in great demand and can be successfully grown only in limited areas giving western North Carolina a tremendous competitive advantage. The following species descriptions include trees that may be grown in North Carolina.



Fraser fir

faces) are less important. At lower elevations southerly aspects are less favorable. Fraser fir is sensitive to drought conditions and to poor soil aeration at any elevation. Poor soil drainage impedes soil aeration and greatly increases the probability of the trees being killed by root diseases. Locations with poor air drainage form frost pockets resulting in damage or outright killing. Soil fertility is important but can readily be adjusted on the basis of a soil analysis.

Fraser fir grows slowly at first, but it also brings the highest price of any Christmas tree grown in North Carolina. Even when on good sites, Fraser fir plantings can be damaged or will die if attacked by Balsam woolly aphids. Mites are also a serious problem. Well-drained 4 or 5 year old 8 to 12 inch transplants will require 7 to 12 years to grow into 7- to 8-foot trees.

Balsam fir is a native of Canada and northern United States. The southern limit of its natural range is in the mountains of West Virginia. Balsam fir, sometimes called Canada balsam, has many characteristics similar to those of Fraser fir. When Balsam fir is planted in North Carolina on sites similar to those described for Fraser fir, it usually develops much like Fraser fir but is of lower quality. Ten to 15 years are required to grow 7- to 8-foot trees if well-graded 8- to 12-inch plants are set.

Douglas-fir is native to the western United States where it occurs in many different environmental conditions. Several strains and one definite variety are recognized. At one time, Douglas-fir was the most popular Christmas tree in the United States. This tree has good color and needle retention, but its limbs will not support heavy ornaments as well as limbs of Scotch pine or Fraser and Balsam fir. It also lacks the

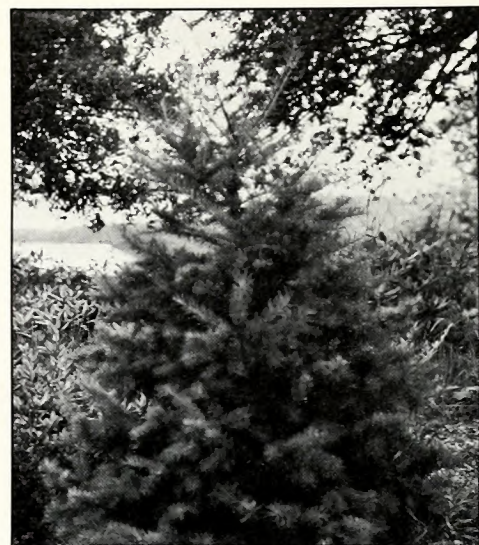


Fig. 2. Douglas-fir

pleasing aroma of the latter two species. Within its natural range, Douglas-fir has become adapted to different combinations of climate and soil. In North Carolina, sites suitable for Fraser fir would be suitable for Douglas-fir and nominally safe, but even then it might suffer serious insect attack from grasshoppers. Douglas-fir is susceptible to drought and late frost damage in North Carolina. To grow 8-foot trees requires at least 12 to 15 years.

White pine is a native tree of western North Carolina at elevations between 1,200 and 3,500 feet. It has a soft blue-green foliage, pleasing fragrance, and good needle retention. This pine is becoming more popular with consumers despite its tendency to wilt and its rather weak branches. Within its natural range satisfactory growth of white pine is seldom hampered by variation in slope (gradient), aspect, or elevation below 3,500 feet. Outside the tree's natural range, however, a planting site must be chosen carefully. White pine is susceptible to root diseases, although not to the same extent as Fraser fir. When planting white pine, avoid wet spots. Air drainage is also needed to avoid frost damage. White pine is very sensitive to air pollution and is occasionally attacked by aphids. Soil fertility can be readily adjusted to levels recommended after soil analysis. On Piedmont sites, white pine should be restricted to northern slopes containing well-drained moist soils. Regardless of aspect, avoid soils of the Piedmont that are underlain by a relatively impervious layer of plastic clay within a foot



Fig. 1. Fraser fir

Fraser fir is one of the most attractive species used for Christmas trees in the Western Hemisphere. This fir has a natural Christmas-tree shape, glossy dark-green foliage, strong branches which easily support ornaments, pleasing aroma, and excellent needle retention. Fraser fir has a highly restricted natural range in western North Carolina, eastern Tennessee, and southwestern Virginia. It occurs naturally in areas of high rainfall (70 to 90 inches) at elevations above 3,500 feet. Fraser fir, however, is being grown successfully in plantations on fertile, moist, well-drained soils down to elevations of 1,500 feet where rainfall is somewhat less. Above elevations of 3,000 feet, soil characteristics and aspect (direction toward which slope



Fig. 3. Eastern white pine

of the surface. White pine has been grown in the Coastal Plain, but there is abundant evidence that extension of the species beyond its natural range is risky business. Progress is being made in selecting strains with improved form and color. Thus, we can look forward to new strains becoming available. It takes 7 to 10 years to grow a 2-year-old seedling to a 7- to 8-foot merchantable Christmas tree.

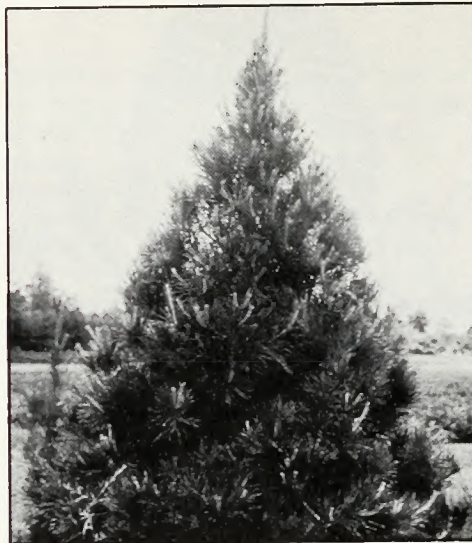


Fig. 4. Virginia pine

a Christmas tree. It can be grown on a variety of soils from the Coastal Plains into the lower mountains. Growth is rapid, so rotations of 4 to 6 years are possible. At present, quality is only moderate. Virginia pine is much less sensitive to soil fertility than Fraser fir or white pine, but fertile well-drained soil is obviously best for vigorous growth with dark green foliage. The tree is subject to rust canker but the main



Virginia pine

popularity, in the future it may still find use for local markets. Its chief disadvantages are prickly foliage, often poor form and color, and limber branches. Redcedar dries out quickly after cutting unless the stem base is kept in water. This species should be marketed locally because it is not suitable for shipping. Redcedar grows best on loamy soils of limestone origin, but it can be grown as a Christmas tree, with little shearing, on almost any site in North Carolina. There is wide variation in color, shape, disease resistance and needle type among redcedars. Many redcedar trees in the wild represents escapes from ornamental selections.

Spruce species. White spruce from Canada, blue spruce from western United States, and Norway spruce from Europe are being grown in North Carolina. All of them grow slowly and, except for Norway spruce, they require from 10 to 15 years to grow to Christmas tree size. In addition to the slow growth, susceptibility to several pests may increase the cost of production. Norway spruce is plagued by white pine weevil, mites and aphids. Needle cast diseases hinder blue and white spruce. Spruces may be grown in the mountain areas but are better suited as ornamentals, not Christmas trees.

White fir grows naturally in various parts of western United States. Introduced in very limited quantity to the North Carolina mountains, white fir is grown with varying degrees of success. This fir has long needles of excellent blue-green color. Both needle retention and shipping qualities are good. The Rocky Mountain seed source is recommended for North Carolina, and site requirements are similar to those of other fir species. It will take 10 to 15 years to grow white fir to merchantable size.



Eastern white pine

Virginia Pine. Considerable progress is now being made in selecting Virginia pine strains exhibiting good Christmas tree characteristics. Native Virginia pine generally is of poor form and color; thus these characteristics detract from its use as



Fig. 5. Redcedar

problem that you may have will be caused by tip moths. If poor color proves to be a problem, it can be corrected by artificial coloring before marketing.

Redcedar, for many years, has been the traditional native Christmas tree in the Piedmont and Coastal Plains of North Carolina. Although it has declined in

Establishing a Christmas Tree Plantation

The main steps to consider in establishing a Christmas tree plantation are (1) selecting a proper site and (2) preparing that site adequately for the species to be planted. Suitability of the species to the site is of critical importance. Topography, surface conditions, vegetative cover, and accessibility to good roads are other factors that require careful attention.

Site Selection and Planning

First and most important is suitability of the site for the species to be grown. Suitability hinges largely on soil characteristics and elevation. Unsuitable soil results in heavy losses to root diseases. Obtain professional advice if you are uncertain about a site's suitability for a particular species of tree.

Damage by late spring freezes is always a possibility. This type of damage is likely to occur in "frost pockets" where air fails to flow freely to adjacent lower areas.



Fig. 6. All perennial plants must be removed before planting Christmas trees.

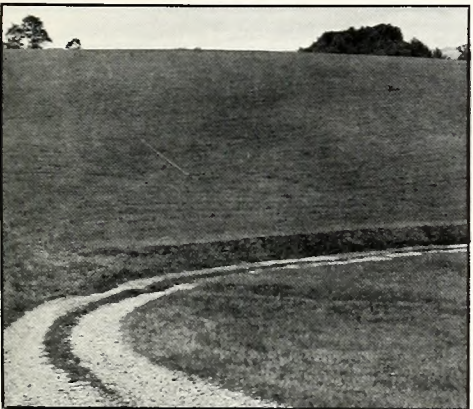


Fig. 7. Pasture area should be mowed and herbicide applied the fall before spring planting. Apply herbicides in bands 36 inches wide on contour or in spots 36 inches in diameter.

Slopes facing south and southwest have warmer, drier soils in contrast to north and east aspects which are cooler and more moist. Earliness of the former sites can make 2 weeks difference in spring bud-break, thus increasing the possibility of possible freeze damage. Dry, warm sites also may cause important differences in survival and site-species relationships.

Efficiency of operations is directly involved in locating roads within the plantation.

So many operations usually require the use of machinery with access depending on roads. In choosing a site, consider carefully what kind of machines are likely to be used and in what seasons.

Harvesting must be done at times during very bad weather. Here a good access road to the plantation becomes critical. However, easy access encourages theft. Almost all growers lose a few trees to those who "borrow" a single tree. Poor security plus easy access invites theft by the truckload. Plantations along public roads invite this kind of problem. For security the best location is at the end of a dead-end road with a single egress back to any public thoroughfare. Occupied dwellings with a good view of the plantation reduce the problem a great deal.

Next is the plantation layout, including direction of rows and spacing, road location, work areas, etc. Roads through and around the field should be marked off and the necessary drainage culverts and grading done prior to any planting. It does not take long for the time, labor, and other expenses saved by an adequate road system to repay its cost. (Seek professional advice on road construction.) This saving applies to both construction costs and land lost to production by space allotted to roads.

"Edge effect"¹ areas make excellent roads and equipment turn-arounds. No spot in the plantation should be more than 100 feet from a road. Some large growers are spacing roads as close as 85 feet apart. This spacing facilitates spraying from the road with tractor mounted or drawn equipment. There are other important advantages to this layout. Fifteen feet between rows should be left for secondary roads, with main roads wider. With crown

¹ Small trees do not do well near large trees. This is because the small trees cannot compete satisfactorily with large trees for sunlight, water, and nutrients. Some species compete better than others because of nutrient requirements and of differences in tolerance to shade and drought.

development, the 15 feet shrinks to 10 feet or less before the trees are harvested, and is about minimum to accommodate operation of trucks, tractors, and other machines without damage to the trees. Roads may be constructed using the "reverse slope"² method to reduce erosion. All-weather roads to the plantation should be surfaced with a granular material. Roads within the plantation that are used less frequently should be fertilized and seeded to grass to produce heavy sod. Regular road maintenance and sod renewal will pay off when roads must be used during unfavorable weather.

Some growers like to leave wider spots in the roads at strategic locations for work centers and collection points in harvesting. Allocation of work areas however, is not of critical importance, and many growers operate without them.

Selecting the Species

After carefully studying the characteristics of each species, you will need to consider several questions before deciding which species to grow. Some of these are:

- (1) Is there a good market for this tree?
- (2) Can it be grown on the land available?
- (3) Are there any special problems in growing this species?

Table 1 shows which species can be grown in each part of North Carolina. Planting in areas not recommended usually results in poor survival and growth or even total loss.

The final choice of species depends on the availability of suitable land.

Table 1. Some Species of Christmas Trees That Can Be Grown in North Carolina

Coastal Plains	Piedmont	Mountains
Redcedar ¹	Redcedar	Fraser fir
Virginia pine	White pine	White fir
White pine	Virginia pine	Balsam fir
		Virginia pine
		White pine
		Redcedar ^{1,2}
		Douglas-fir

¹ For local sales—not suitable for shipping.

² Do not plant within a mile of a commercial apple orchard. This species may carry a fungus causing cedar-apple rust.

² Reverse slope has the road sloped toward the hill. Collected water then has to be removed by culverts or water bars.

Site Preparation

Adequate soil testing³ for nutrient levels is the first step prior to preparing the site. Phosphate and lime do not move readily in the soil and are not susceptible to rapid loss by leaching. Consequently, if soil tests show that these materials are needed, they should be worked into the soil before any planting. Broadcast application followed by discing to a depth of 4 inches is a good way to mix the materials with the soil. Discing need not be deep.

On sloping land some growers are reluctant to tear up established sod for fear of accelerated erosion. If heavy rains occur before new sod becomes re-established, severe damage through loss of valuable topsoil may result. To reduce the erosion hazard, a rototiller has been designed to prepare sodded sites. This machine drops the desired amount of fertilizer just ahead of the tiller which thoroughly mixes it into a strip of soil 2 to 4 feet wide and 4 inches deep. When tilling is done in the fall, a small seeder is mounted at the rear to seed the strip to rye or some other cover crop. Fall tilling avoids the usual spring tillage when the soil is often too wet. Trees are then set in the center of the strip. This procedure also eliminates established plant competition near the newly set tree and softens the soil. The result is more root growth, better survival, and more top



Fig. 9. Erosion hazard may be reduced by using a rototiller.

³How to get soil test: Soil, plant and nematode testing is provided by the Agronomic Division of the North Carolina Department of Agriculture, Raleigh, N. C. 27611. Get instructions for taking soil samples from your local county extension agent.



Fig. 10. Annual rye, or some other small grain, may be effectively used as a "nurse crop." The rye reduces erosion, weeds, and provides protection from the winds.

growth. Thus, the newly set trees are off to a better start. On former pasture land which is often severely compacted, this scheduling of site preparation is especially important. As much as possible, tilling is done on the contour to minimize erosion problems.

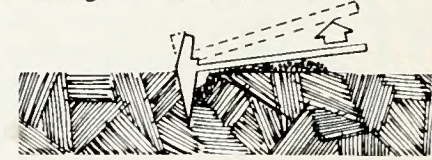
If the soil analysis shows a need for sulfur and phosphorus, these nutrients can be made available to the newly set trees immediately by working 20 percent super phosphate into the soil before planting. This phosphate contains 11 to 12 percent sulfur. Phosphate or lime placed on top of the soil moves so slowly or becomes fixed at the surface and thus remains unavailable to the major root zone of trees for 2-3 years. In the interim, shallow-rooted plants such as grasses, are apt to pick up fertilizer and move it throughout the plant. In this process, some fertilizer will go to the deeper parts of the root systems which later die, thus making the phosphorus and sulphur available to the trees.

One of the important functions of phosphate fertilizing is to lessen transplant shock. This can occur only if the phosphate is immediately available to the newly set tree. Without working the phosphate into the soil, this important function cannot be fully realized.

Nitrogen moves readily into the soil when placed on the surface. Nitrogen, however, must not be placed so close to the trees as to burn them.

The following illustrations will show how to

Planting with a Mattock



Drive blade straight into ground. Raise up handle and pull dirt to edge of hole. Repeat until hole is deep enough so roots of seedling will not be crowded.



Take seedling from bucket. Place against sharp side of hole so that tree is about as deep or a little deeper than it stood in the nursery bed.



Partially fill in hole, packing the soil with your hands.



Finish filling hole and pack soil firmly with your feet.

Fig. 11. Leave hole open after removing planting.

Where machinery is to be used, surface conditions assume much greater importance. Most plantations need mowing for weed control at least once annually. Chemical weed control is possible, although not so generally reliable as mowing. On slopes too steep or surfaces too rough for larger machines, walk-behind mowers are a satisfactory substitute. On rough surfaces workers will move slower, thus increasing labor costs. Bumps and dips, stones, stumps, etc. make all machine operations more difficult. Remove these obstacles as completely as possible before planting. On steep slopes where machines cannot be controlled on the contour, mowing up and down slopes is permissible because mowing *per se* does not disturb the soil.

Christmas-tree seedlings should be planted:

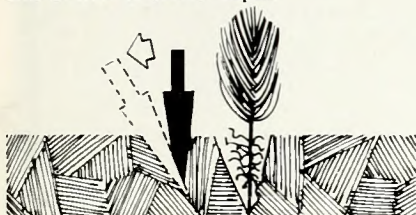
Planting with a Spade-type Tool or Bar



Drive blade at slight angle into ground. Pull up on handle to open hole.



Let helper take seedling from bucket and place in hole. Have him hold it against sharp side of hole at correct depth.



Drive planting tool into ground about 3 inches behind planting hole. Pull back on the handle first. This closes the bottom of the planting hole.



Leave hole open after removing planting tool except in loose sands or light loamy sands.

tool, except in loose sands or light loamy sands.

Perennial plants such as tall grasses, vines, briars, and brush, and other unwanted vegetation should be eliminated as completely as possible before planting. After planting, control is less satisfactory and more expensive.

Finally, it is not enough to know that the site you select is suitable in elevation, soil type and location for the species to be grown. There must be adequate expenditure of time, labor, and materials in planning the layout of the area and preparing the site. Proper attention to these phases can spell the difference between success or failure of the entire venture.

Selecting the Planting Stock

Regardless of species, choosing the right planting stock in terms of age, size, and quality is very important. Healthy, vigorous nursery stock may mean earlier harvesting by a year or more. Several private nurseries and the North Carolina Forest Service nurseries grow and sell species suitable for Christmas trees. A list of out-of-state nurseries offering Christmas tree stock can be obtained from county agents or by writing to the Extension Forester, North Carolina State University, Raleigh 27607.

Growing Your Own Planting Stock

If a suitable nursery site is available, you can grow your own seedlings. If you buy seed, be sure to deal with a reputable firm that guarantees origin of source of seed. An alternative is to collect your own seed. In either event, the seed should be tested⁴ and treated before sowing.

Seedbed

The nursery-bed site should be level, fertile, deep well-drained, stone-free, sandy loam, at least 12 inches deep, made free of perennial vegetation. The soil should be tested for nutrient deficiencies and the seedbeds fumigated (with methylbromide) before sowing.

Prepare seedbeds in the fall. Seedbeds should not be over 4 feet wide with 2 feet between the beds to be used for plants. Elevate beds 4 to 6 inches above paths. In the spring, pulverize soil about 2 inches deep and plant the seed. Sow about 20 percent more seed than needed to cover losses by insects, diseases, birds and rodents. Spacing varies with the species and how long the seedlings will be left in the seedbed. Firs and spruces should have a density not exceeding 40 to 50 plants per square foot. Pines and redcedar should have a spacing of not more than 35 plants per square foot in the seedbed.

After sowing, cover beds with pine straw, sawdust (finely subdivided), hardwood bark (hammermilled and screened), peat moss, or some other similar material. This conserves moisture and protects tender plants during germination and early establishment. It may be necessary to cover

beds with a mesh wire to prevent removal of mulch by wind. Burlap cloth may also be used as a mulch and cover combined.

If soil tests show a need for phosphate or lime, mix the material with the soil as recommended before planting. Use nitrogen and potash fertilizer sparingly the first year. In the second year, in average situations, top-dress with about 150 to 300 pounds of ammonium nitrate per acre in split applications of not over 50 pounds per acre each week from late May to August if seedlings lack vigor and good color.

Irrigation water of suitable quality should be available and applied to the beds as needed each day following sowing. During rainless periods, water beds at the rate of approximately 1 inch per week after germination and continue to water at this rate during the first growing season.

Above 3,000 feet elevation, Fraser fir seedlings develop better if grown under 30 percent shade the first year and no shade the second growing season. At lower elevations, Fraser fir may need 80 percent shade the first year and 30 percent the second year. To provide shade, place plastic netting on a staked wire frame 18 inches above the beds.

Transplant firs and spruces after 2 or 3 years in the seedbed. This disturbance stimulates the root system and makes for a better-developed plant above the ground. Transplant beds should contain soil similar to that in seedbeds. Irrigate as needed. Pines and redcedar are usually developed enough for outplanting directly from the seedbed.

Space seedlings 4 to 6 inches apart in the transplant beds. A transplant board and a trenching tool will speed transplanting. Transplant seedlings with the roots fully extended and the stems upright. Properly handled transplants will be straighter and easier to outplant.

Outplanting the Trees

After the site has been correctly selected and prepared, obtain planting stock or seedlings. Assuming droughts do not interfere, success of outplanting will depend on the care given the plants prior to and during planting. Planting dates vary with geographic area. Plant during dormant season, using the following as a guide:

⁴ Address for testing: Seed Testing Laboratory of the U. S. Forest Service, Macon, Georgia and New York Agricultural Experiment Station, Geneva, New York

Coastal Plains	January through March
Piedmont	February through April
Mountains	March through May

Avoid planting when surface soils are dry; likewise, on waterlogged, or frozen soils, and during freezing weather.

Cost of planting varies according to site conditions, topography, and available labor. Table 3 below indicates an average planting time per 1,000 seedlings under different conditions.

Table 2. Labor Requirements for Planting 1,000 Tree Seedlings* (not transplants)

Equipment Used	Conditions	Man-Hours Required
Mattock or bar	Smooth—Piedmont, mountains	13
Bar	Light—easy-to-work land	7 to 10
Machine	Open, smooth land	3 to 6
Space	Open, mountains	25

*Transplants will require more time.

If seedlings are to be planted within a 4-week period after they arrive, you can safely hold them in the shipping package provided the following instructions are followed:

From time trees arrive until they are finally set out, stow them in a cool place and see that roots are not allowed to dry out. Failure to keep the roots moist has been a major cause of many unsuccessful plantings.

Carry trees from package to planting site in a bucket, tree-planting bag, or tray with damp moss cover on roots. Be sure to remove trees from bucket one at a time as each hole is dug. Never grab several trees and leave them exposed to dry out.

Table 3. Years Required to Grow Adequate Size Stock or Seedlings

Species	Years in Seedbed	Years in Transplant Bed
Spruce	2	2
Fir	2	2
Douglas fir	2	2
White pine	2	0
Virginia pine	1	0
Redcedar	1	0

Several planting methods have been used successfully, depending on the particular planting site and topography. In the Coastal Plain and Piedmont regions, most open-field planting is being done by tree-planting machine, planting bar, or spade. In the upper Piedmont and mountains, the spade is still the most popular planting tool, but in rocky soils a mattock may prove most useful.

If the planting site is suitable, the machine method of planting is more efficient. Some tree planters are equipped to space trees precisely resulting in equal

distances between trees within rows. Precise spacing is advantageous for Christmas-tree planting, because it makes mowing for weed and grass control much easier and safer.

Christmas trees should be planted "in-line" in either straight rows or in rows on the contour.

"Off-set" trees may be damaged or destroyed by machinery used for cultural practices, especially mowing. To keep trees in-line and uniformly spaced, a line such as a plastic clothes line may be used with markings at desired intervals. Lighter materials may be used for spacing at the risk of being moved about by the wind.

Spacing trees the correct distance apart is very important to grow quality trees. Many feel that spacing trees 6 feet apart is about minimum spacing for trees to be sold at 6 to 9 feet. However, some growers are spacing fir as close as 4½ feet apart and selling small trees (3 feet to 5 feet), thus, increasing the space for larger trees. Keep

in mind that as the trees get larger they will shade adjacent trees, reducing quality.

Rows may be spaced 6 feet apart or more depending on the size of machinery to be used for mowing and other cultural practices.

Stagger trees in rows that are oriented in an east-west direction to allow maximum sunlight as shown in drawing below.



On areas too rough for machine planting, the planting bar and spade may be the best and most efficient tools for planting.

Necessary Cultural Practices

This publication does not give specific information or suggestions concerning the use of specific pesticides for the control of specific insect or mite problems. The *N. C. Agricultural Chemicals Manual* is revised annually and should be referred to for the most up-to-date pesticide information.⁵

Caution: Pesticides can be injurious to humans, domestic animals, desirable plants, and fish or other wildlife — if they are not handled or applied properly. Use all pesticides selectively and carefully. Follow recommended practices for the disposal of surplus pesticides and pesticide containers.

BAGWORMS (*Thyridopteryx ephemeraeformis* (Haworth)): Caterpillars, which live in bags made of foliage and silken threads, prefer to eat the needles of redcedar; however, they will also cut the foliage of other conifers. The sign that bagworms are present is their bags.

Young bagworms can be controlled in June with an approved insecticidal spray. In the fall and winter, when the eggs are present in the bags attached to trees, remove and burn the bags. Many times, natural enemies will keep bagworms from becoming too numerous.

⁵*N. C. Agricultural Chemicals Manual* can be purchased from the Division of Continuing Education, P. O. Box 5125, N. C. State University, Raleigh, North Carolina 27650.

BALSAM TWIG APHIDS (*Mindarus abietinus* Koch): These aphids are small soft-bodied insects often covered with a white cottony material; they suck sap from the current year's shoots and needles of spruce and true fir, including Fraser fir.

The most obvious sign that twig aphids are present occurs during the spring when new developing needles curl upward so that the needle's blue-green underside is visible. The foliage may also be sticky to the touch due to the presence of honeydew. In addition, clusters of white cottony material produced by the feeding aphids is often present on and among the needles.

In April, aphid eggs hatch and young aphids begin feeding on the succulent young developing needles. Aphid feeding, development, and reproduction continue throughout the spring. During May, winged aphids develop and they often fly to other trees. By the end of June, all aphid forms disappear and only eggs remain. These eggs, which look like tiny, white, cottony spots in the crevices of bark, do not hatch until the next spring.

Balsam twig aphid feeding can cause:

- permanent needle distortion, particularly on lower branches and on trees of reduced vigor,
- premature needle drop,
- poor needle retention, and
- reduced shoot development.

Balsam twig aphids can be controlled by applying approved insecticidal sprays in the spring prior to the start of new growth and before needles are drastically curled. Once the needles are curled, spray penetration is reduced. At this stage the population of twig aphids has already begun to decline. If numerous permanently curled needles are present in the fall, an application of insecticide may be necessary the following spring.



Fig. 12. The Balsam twig aphid attacks needles as they develop early in the spring.

BALSAM WOOLLY APHIDS (*Adelges piceae* (Ratzeburg)): These aphids are tiny soft bodied insects which appear as white woolly spots. They suck sap from, and inject growth stimulating substance into, the stem and branches of true firs, including Fraser fir.

The white woolly spots or "whitewash-like" material are the most visible sign that these aphids are present. These spots are secreted at the base of buds and needles by the tiny aphids while they feed on the stems and branches. Other signs often include stunted shoots, gouting (swollen, distorted buds and branches), and dieback.

During the spring, immature female aphids resume feeding and mature about the time buds begin to swell. In May, eggs are deposited and hatch, producing immature aphids which crawl about seeking a sheltered place to settle. These newly hatched immatures are often dispersed by wind and birds to other trees. After settling down, the aphids feed (and secrete the white woolly material which will eventually cover them), develop, and reproduce until late fall. By late fall, only the immature female aphids remain where they are feeding, and they are settled and prepared to overwinter.

Balsam woolly aphids can cause:

- defoliation of needles and thickened discolored wood which inhibits the movement of water and food within the tree,
- gouted buds and branches,
- reduced shoot elongation,
- poor needle development, and
- branch and tree mortality.

To minimize the hazard of balsam woolly aphids in fir Christmas tree



Fig. 13. Cottony like material shown here indicates Balsam woolly aphids have been present several years. Early detection is difficult.

plantations, it is important to discover the presence of the aphids as soon as possible.

- Do not plant infested seedlings or stock.
- Inspect bark surface of trunk and limbs of standing trees frequently to determine the presence of the aphids.
- Inspect the butt of cut trees for white woolly patches and the cut surface for thickened, discolored growth rings.
- Thoroughly spray infested trees during May through October with an approved insecticide applied as a forceful stream directed at the entire tree.
- Cover infested trees (with a large plastic bag if possible), and cut, remove, and burn heavily infested trees from October to April.
- Protect apparently non-infested trees growing near infested trees with an approved insecticide.

DEODAR WEEVILS (*Pissodes nemorensis* Germar): These weevils are small, tan, snout-beetles which look like white pine weevils; however, the annual life cycle and breeding habits of these two

weevils are quite different. Deodar weevils chew on the branches and shoots of various conifers including deodar cedar and pines.

The presence of dead branches and dead or dying trees are an indication that these weevils could be present. The deodar weevil does not seem to be as an aggressive tree-killer as the white pine, the pales, and the pitch-eating weevils can be. However, the whole story is still not known about the deodar weevil.



Fig. 14. Chewing insects attack the tender developing leader causing serious injury.

The presence of a small number of deodar weevils in a Christmas tree plantation is almost impossible to detect or prevent. If a large number of weevils are present, shoots and branches could be pitted or scarred and killed as a result of weevil feeding.

Deodar weevil infestation can be reduced by following both the white pine weevil and the pales and pitch-eating weevil control procedures. Generally, removing and destroying high stumps, discarded limbs, and dead trees will eliminate most of the potential deodar weevil breeding sites.

JAPANESE BEETLES (*Popillia japonica* Newman): These beetles present no problem with cut Christmas trees. However, before shipping balled and burlapped trees out of North Carolina into or through South Carolina, Georgia, Tennessee, and states beyond, the following precautionary measures must be applied:

1. The root ball-area of undug trees or root ball of dug trees must be treated with an approved insecticide to control Japanese beetle eggs, grubs, and pupae; and

2. The trees must be inspected and certified by an Inspector of the N. C. Department of Agriculture.

Your local office of the Agricultural Extension Service or a district office of the N. C. Department of Agriculture can provide additional information.

PINE BARK APHIDS (*Pineus strobi* (Hartig)): These aphids are tiny soft-bodied insects which appear as white cottony spots; they suck sap from the stem and the underside of branches of white pine.

Again, the white cottony spots of "whitewash-like" material are the most visible sign that bark aphids are present. The spots are secreted by the tiny aphids while they are feeding on the stem, the underside of branches, and among the base of needles on new growth.

Pine bark aphids can be controlled by applying an approved insecticide as a forceful stream on a warm day. Direct the spray at the white infested portions of the tree's stem, branches, and new growth.

PALES WEEVILS (*Hylobius pales* (Herbst)) and **PITCH-EATING WEEVILS** (*Pachylobius picivorus* (Germar)): These weevils are dark brown or black, robust, hard-shelled snout-beetles. They chew on the bark of conifer shoots, branches, and seedlings, particularly of pine. The biology, damage, and control of these pine reproduction weevils are similar, and are discussed here with reference to Southern Appalachian conditions. In the Piedmont and Coastal Plains, their biology varies to some degree, but the nature of the damage and the mode of control remain the same.

Dead or dying new pine seedlings, older tree branches, and shoots are usually the first noticeable indication that these weevils are present. The bark at the base of young seedlings fed on by these weevils will appear to be either completely or partly removed. On older pines, small resin-filled holes or pits in the bark of stems, shoots, and (living or dead) branches are signs of weevil feeding.

The presence of a small number of pales or pitch-eating weevils in a Christmas tree plantation is almost impossible to prevent. When large numbers of weevils are present, newly planted seedlings are likely to be killed, and shoots and branches of older trees become pitted or die.

To minimize the likelihood of pales and pitch-eating weevil infestation:

- Let a complete summer (June, July, August and September) lapse after a fresh cutting before establishing a new Christmas tree plantation.

- On a cut-over site near a Christmas tree plantation, burn all fresh stumps and logging slash.

- Remove high stumps and discarded limbs of Christmas trees from such plantations.

- Never plant new seedlings beside fresh stumps.

- If new seedlings are to be planted immediately as replacement, chemically treat or remove recently cut stumps.

Insecticides can be used to protect newly planted pine seedlings. However, these insecticides can be time-consuming to apply, and if proper safety precautions are not strictly followed they can be very poisonous to humans.

NANTUCKET PINE TIP MOTHS

(*Rhyacionia frustrana* (Comstock)) and **PITCH PINE TIP MOTHS** (*Rhyacionia rigidana* (Fernald)): These moths are small insects which have a small, orangish-colored caterpillar stage that bores into pine shoots (tips) and buds. White and longleaf pines are seldom if ever attacked. The appearance, biology, damage, and control of these insects both in their moth and their caterpillar stages are similar.

The brown or rusty-red, dead pine tips is the most noticeable indication that tip moths are present. Dead needles on a tipmoth-killed shoot are not so long as the living needles on the undamaged part of the shoot.

Insecticides are approved for controlling pine tip moths. Systemic insecticides, either sprays or granulars, can provide better control than non-systemic insecticides. To obtain the best control with systemics:

- Apply the granular systemic with sufficient lead-time to allow the chemical to move into the new growth.

- Water in insecticide unless a light rain follows application of a granular systemic.

- Apply enough insecticide to insure that subsequent growth does not dilute or reduce the insecticide's effectiveness.

Although the practice is untested, late winter shearing of trees prior to the spring emergence of tip moths could prove effective in reducing the number of tip moths within the plantation.

PINE SAWFLIES: These caterpillar-like insects eat pine needles. The **REDHEADED PINE SAWFLY** (*Neodiprion lecontei* (Fitch)) has caterpillar-like larvae with a reddish head and rows of black spots on its yellowish body. The larvae feed on Scotch, Virginia, and White pine. The **VIRGINIA PINE SAWFLY** (*Neodiprion pratti pratti* (Dyar)) larvae have a black head and pale green body with black stripes and feed on Virginia pine. The biology, damage, and control of these pine sawflies are similar.



Fig. 15. Spruce spider mites suck sap from needles of most conifers, including Fraser fir.

You might see groups of feeding sawflies on pine needles. Other indications that sawflies were probably present are the reddish-brown, frizzled straw-like frass remains of incompletely consumed needles or the bare twigs stripped of needles.

Pine sawflies can be controlled with an approved insecticidal spray. Additional applications may be needed if more than one generation occurs.

SPRUCE SPIDER MITES (*Oligonychus ununguis* (Jacobi)): These mites are tiny, soft-bodied pests which suck sap from the needles of most conifers, including Fraser fir.

During the summer, spider mite-infested needles first appear off-color at a distance and speckled or stippled up close. If the number of mites increases, the damaged needles can become rusty, bronze, or brown in color by late summer or early fall. In addition, webbing produced by the mites is visible on needles of heavily infested trees.

The presence of spider mites can also be detected by sharply shaking or striking with one hand the foliage suspected of being infested while holding a piece of white cloth (handkerchief) or paper under the

foliage with the other hand. If spider mites are present, they can be seen moving about on the cloth or paper. Rubbing or patting foliage between the palms of both hands or a white cloth is another method. If spider mites are present, streaks of reddish-brown mite "blood" will be seen. The best procedure is to periodically examine the tips of new foliage with a 10X hand lens.

In the spring, mite eggs hatch and mite feeding, development, and reproduction occur almost continuously throughout the spring, summer, and early fall. During these periods of activity, mite infestation can be spread by wind. In the fall, overwintering eggs are laid among bud scales and at the base of needles.

Spruce spider-mite feeding can cause poor needle color, premature needle drop, and poor needle retention.

A number of effective miticides are approved for spider mite and spruce spider-mite control. To minimize the presence of spruce spider mites in a Christmas tree plantation:

- Inspect trees frequently during the spring, summer, and early fall for spider mites or any signs of their presence.
- Spray only when economic damage threatens to occur, usually during the drier period of late August, September, and October.
- Avoid routine spraying because natural control agents may be killed.
- For generally greater effective sprays, apply in late summer and early fall.
- Spray thoroughly because coverage and penetration of infested foliage is essential.
- Alternate the choice of miticide to avoid repeated applications of the same miticide.

WHITE PINE APHIDS (*Cinara strobi* (Fitch)): These aphids are small, black, soft-bodied insects with white spots along the sides of their body. They suck sap from branches and shoots of white pine.

Light aphid infestation causes little damage. Pines maintained in a vigorous condition are more able to tolerate and recover from aphid injury. However, heavy persistent aphid infestations can cause needles to yellow and wilt, small trees and individual branches of larger trees to die, and branches and foliage to be blackened with sooty mold.

When white pine Christmas trees or foliage are brought indoors, the overwintering aphid eggs often will hatch

and the aphids will become a nuisance.

White pine aphids can be controlled by applying an approved insecticide as a forceful stream directed at the infested portions of the tree. Two applications at 7- to 10-day intervals might be needed. Also, better control is often obtained if insecticides are applied on a day when the temperature remains 65°F or higher for a few hours after spraying. Many times, particularly during the spring and summer, natural enemies will keep the aphid population at a low level.

WHITE PINE WEEVILS (*Pissodes strobi* (Peck)): These insects are small, tan, snout beetles with two white spots on their rear end. They chew on, and develop under, the bark of white pine leaders. They also attack Norway spruce and Scotch pine.

The first sign of white pine weevil attack, which usually occurs during April and probably goes unnoticed, is excessive pitch flow from adult weevil feeding punctures in the bark of the preceding year's leader. Later in the spring or early summer, the new growth appears stunted, needles wilt, and the new leader withers, assuming the shape of a shepherd's crook.

White pine weevils can be controlled by:

- spraying white pine leaders in the spring with an approved insecticide when either the first sign of attack (pitch flow) occurs or when needles wilt, but no later than immediately after leaders crook; or
- pruning-out and burning all infested leaders before the new adult weevils emerge.

Protection Against Diseases

Diseases of Christmas trees are sufficiently important that growers should become familiar with at least some of the more important diseases to assure successful plantation management.

Phytophthora root rot may prove to be a serious disease in seedlings of many species in nursery beds as well as in out-planted Fraser fir trees and in white pines. In short, its development is favored by excessive soil-moisture associated with poor internal drainage. The disease occurs on two main soil types—(1) heavy soils and (2) shallow, light soils underlain by a layer of impervious clay or rock which hinders drainage.

Affected plants first show a light-green color, followed by a gradual decline in vigor of above-ground parts. Freshly dug infected plants show reddish-brown roots. A laboratory test may be necessary for a positive identification. To be on the safe side, avoid planting seedlings that show disease symptoms.

No adequate control measures have yet been developed for this disease. Soil fumigation with methyl bromide gives some control of the disease in nursery beds, but recurrence is likely within 2 to 4 years. As a precaution, choose the nursery site carefully with respect to drainage.

Needle rusts are caused by several species of fungi that attack the needles of Virginia pine (and other pines) in the spring. The fungus produces bright orange blisters which break and release orange-colored spores. Needle rusts rarely cause severe damage to the trees but may lower their value as Christmas trees. Infection of pines originates from spores that form on alternate hosts such as goldenrod, aster, and certain other weeds. Fortunately, these fungi require certain weather conditions to develop and these conditions do not occur every year.

Needle cast is the name applied to a disease caused by one of several fungi which cause a dieback of older pine needles, often followed by early shedding or "casting." These fungi are intraspecific and do not kill trees but they reduce their value as Christmas trees. From a distance, affected trees have a scorched appearance. The symptoms are most evident in the spring. Remove affected trees from the stand.

Pine-stem rust is indicated by round swellings or galls on the limbs or trunks. In the early spring, orange blisters are produced on these swellings. Prune branches bearing galls before the disease extends to the trunk, or the tree may die. The best time to prune branches that have galls is when the stand is between 3 and 5 years old so that the trees may recover their form before harvest. Oak trees are the main alternate hosts for stem rust fungi.

White pine blister rust is caused by a fungus that forms certain of its spore stages on currant or gooseberry (*Ribes* spp.). This spore enters the needles and grows into the inner bark of branches, where it causes spindle-shaped swellings to form. Three to four years following infection, yellowish blisters form in the bark and produce numerous spores. These spores cannot

infect currant or gooseberry bushes many miles away. The spore stage that infects the white pine is produced on the alternate host in the fall. It is a very delicate spore and does not survive very far from the point of origin. Thus, it is possible to prevent spread of this fungus by eliminating currant bushes within 400 feet of the pines. The early stage of this disease is so difficult to detect that an infection may have been developing for at least 2 years before it is discovered. Prune out infected limbs as far in advance of tree harvest as possible. If the infection reaches the main stem, destroy the tree. This disease is rare in North Carolina.

Emergence tipburn, or needle blight, is usually indicated when white pine needles become reddish-brown at the tips, giving the tree a scorched appearance. The blight usually does not kill trees but does reduce their value. Some trees seem to blight every year, others occasionally. No control is known. This problem is not caused by a parasitic organism but is caused by air pollution. Remove affected trees from the stand.

Protection Against Animals

Domestic livestock and wild animals will damage or kill trees of all kinds. Livestock and Christmas trees should be in separate areas.

In many parts of the state, deer, rabbits, and mice have damaged young trees extensively. Rodent damage usually occurs in areas of heavy grass cover which favors growth of an over-population of these pests. Grass control is usually enough to discourage a rodent population buildup. Local county agents may also recommend rodent control with poison bait.

Fertilizing

Adequate fertilization promotes growth and gives the trees a luxuriant foliage and a deep rich color.

Fertilizer requirements vary with different soils. Have soil analyzed several months ahead of planting to determine the amount and kind of minerals needed.

If soil test shows phosphate or lime to be low, plough or disk these into the soil at least 3 months before planting, if at all possible.

Several weeks after the trees have been outplanted apply 1½ ounces of ammonium nitrate, or equivalent, per plant

in a circle 6 to 12 inches radius around the tree. The following spring repeat the application of 1½ ounces of ammonium nitrate (or equivalent) and in succeeding years increase to 3 ounces per tree if needed.

In the case of pines where nitrogen may not be added each year, it may be necessary to apply nitrogen during the summer before harvest to improve color. Unless fertilizing is accompanied by an effective weed and grass control program, young trees may be choked out by excessive competition.

Shaping and Shearing

Shaping is a must for high-quality Christmas trees. The term *shaping* is applied to any cutting done to shape the plant to its desired appearance. This may be done by shearing or pruning. The term *shearing* is applied to cutting back the current year's growth of the leader and lateral limbs.

Pruning is the removal of injured, dead or diseased parts or wood older than the current growth. Severe cutting should be done early in the life of the plant. Early

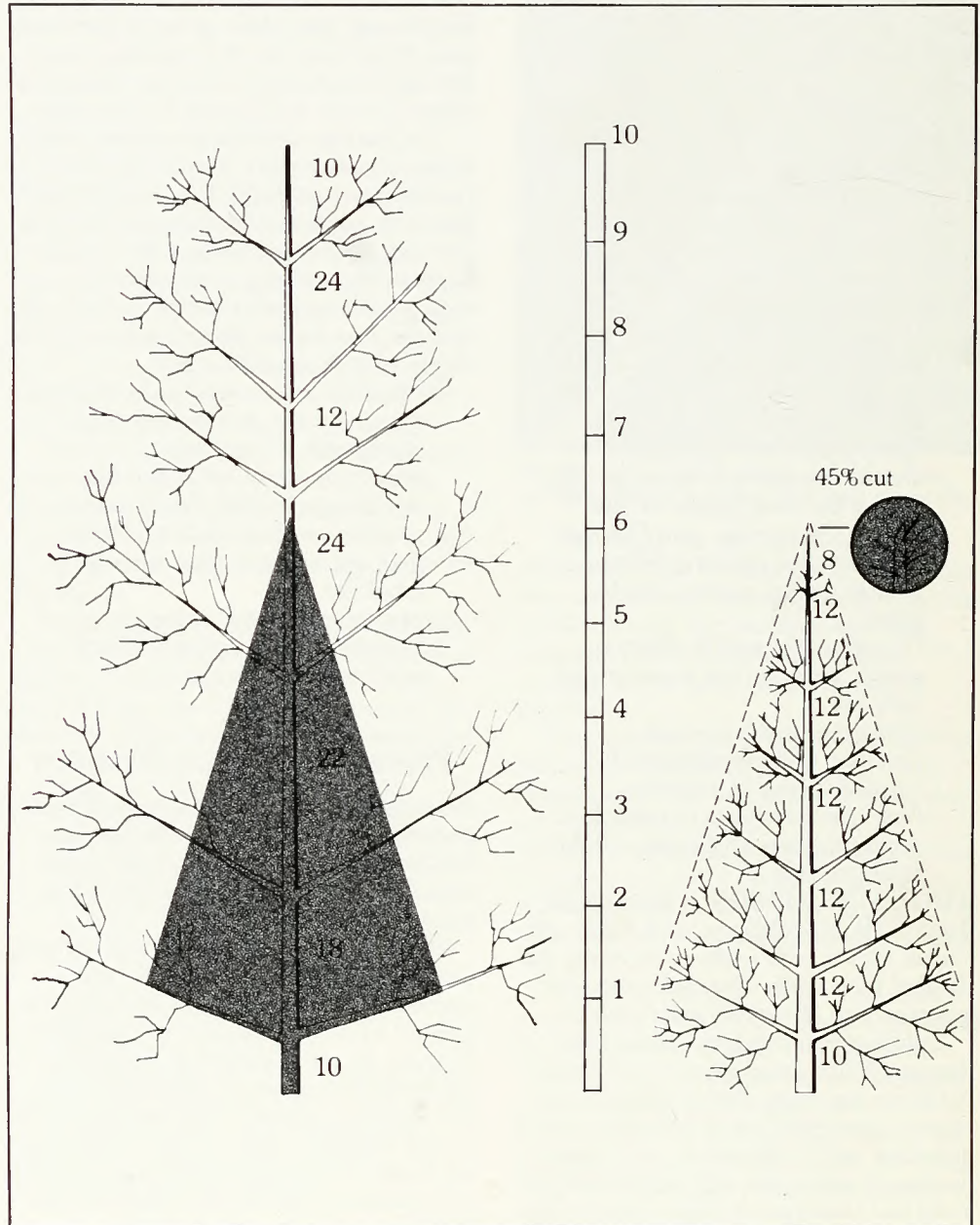


Fig. 17. Both these trees are 7 years old. The one at the right has been sheared to give it a Christmas tree shape. Inset shows correct angle for cutting leader.

shaping may reduce shearing requirements to a minimum the final year before harvest.

Since any one method of shaping is not suitable for all trees, the species will be considered separately.

Redcedar

Redcedar can be sheared lightly at any time of the season with either hedge clippers or knives.

White Pine

It is very important to start shearing white pine at the proper year and season. When tree is about 12 to 24 inches in height, cut off terminal bud to provide more limbs for what will be the base of the tree. Adjust this height upward for a tree growing on a steep slope. Shearing will stimulate more growth buds and make the tree more compact. It also reduces deformities and improves the shape of the tree. The season to shear white pines is between the time the new leader completes its growth and before it hardens. This period of about 3 weeks usually occurs between June 25 and July 15 in the mountains and 2 or 3 weeks earlier elsewhere in the state. These dates vary with the growing conditions, the elevation, and the season.

Sometimes the leader of pines may die back for any one of several reasons. A new leader may be developed by tying one of the limbs near the top to the dead stub. If this is done, use a temporary material (tough grass) that will rot and fall away to avoid cutting into the limb as it grows.

Start by cutting the leader to desired length (10 to 14 inches is usually best) at a 45-degree angle, with the face of the cut in a northerly direction to reduce drying. Then clip the side branches of the top whorl so that they are 3 to 5 inches shorter than the terminal. Next, proceed around the tree and clip the side branches to shape the tree into a cone. *Do not overshear.* Closely shaved trees will look unnatural.

Shear only the current year's growth of white pines unless unavoidable. Older growth does not usually set buds. When the tree is about 3 feet to 4 feet high, cut off bottom branches so that a 10-inch limb-free butt (handle) is available after the tree is harvested.

The ideal shape of a tree should resemble a cone, wide at the base and tapering uniformly to the tip. The ideal tree should be about two-thirds as wide as it is

high. However, acceptable standards for taper will range from a minimum width of 40 percent of height to a maximum of 90 percent.⁶

Some growers prefer shearing pines by using knives with a 14-inch blade, although strong hedge shears may be used. If knives are used, they should have high-quality blades that stay very sharp and require minimum sharpening.

CAUTION: EACH WORKER SHOULD BE EQUIPPED WITH TWO KNIVES, A PAIR OF GLOVES, AND A LEG GUARD. WORKERS SHOULD BE WELL TRAINED AND CAUTIONED AGAINST INDULGING IN HORSEPLAY.

Spruces and Firs

The spruces and firs require different treatment from that given pines or cedars. New leaders of spruces and firs may be cut any time *after* the desired growth is completed (the sooner the better) until the following spring *before* new growth starts. Spruces and firs develop lateral buds along the current leader growth.

When cutting spruces or firs to control height growth, use a knife or hand pruner. Some growers cut the leader in summer. This gives the cut surface time to callous (heal) before winter. The same process may be used in late spring just before dormancy is broken. To slow down lateral branches that may have grown too fast, cut off their terminal during any season. This allows the other limbs to "catch up," thus producing a symmetrical tree.

It is best to use a minimum amount of knife work on the firs and spruces so they will have a natural appearance. *The main thing to strive for is compactness by*

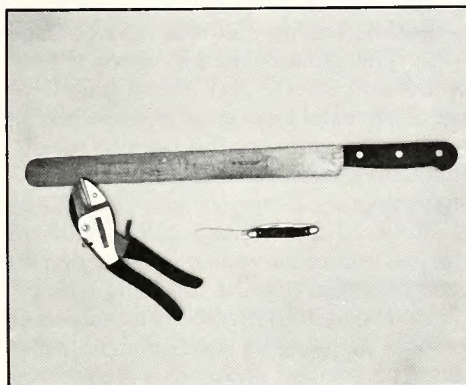


Fig. 18. Tools used for shaping Christmas trees are 14-inch knife, pocket knife, and pruning shears.

⁶Tree taper is computed by dividing tree width by tree height.

controlling height growth. When the trees reach 3 or 4 feet in height, cut off bottom branches so a 10-inch limb-free butt is provided for a handle. Basal pruning too early may slow the growth rate.



Fig. 19. Shearing pines too early in the season may result in more buds than necessary thus producing a "witches broom" effect.



Fig. 20. Shearing pines too late in the season may result in weak buds, too few buds, and sometimes dieback.



Fig. 21. Shearing pines at the proper time produces 5 to 10 well-developed buds.

Weeds, Brush, and Woody-Plant Control

Keeping young Christmas trees free of excessive weed, grass, and woody-plant growth is probably the biggest task in the initial stage of production. Without adequate and sustained control, planting will result in poor survival, slower growth, and irregularly formed trees. On fertile, moist sites, these competitors will take their toll the first 2 or 3 years. Even on poor sites requiring relatively heavy fertilization, weed competition may completely crowd out young trees.

Mechanical

Mowing is an effective way to keep competing plants under control between rows. Properly timed mowing reduces competition, rodents, and the fire hazard. It is important to keep some vegetation between rows to prevent erosion. Rotary-type mowers are preferred for grass control. Sickle bars may cut too many trees.

Chemical

The use of herbicides is an effective supplement to mechanical means for controlling competition by weeds and grasses. Although some vegetation competing with Christmas trees may be woody plants, the main form of competition is usually broadleaved weeds and grasses. It is important to keep some vegetation between rows to prevent erosion and as an alternate host for mites. Herbicides should be used in bands or spots around trees. Too much vegetation not only damages the trees but may also encourage rodents and increase the fire hazard.

The toxicity of a chemical may vary from no response to 100 percent response, so you should choose the herbicide to match the situation. Examples of possible different use of chemicals are new plantings in a cleanly cultivated field, new plantings in a sod, or established plantations. Response to chemicals will depend on several factors such as time of application, soil composition, rainfall, temperature, size, kind and growing condition of target plants, rate of deterioration before being incorporated into the soil, and persistence of the chemi-

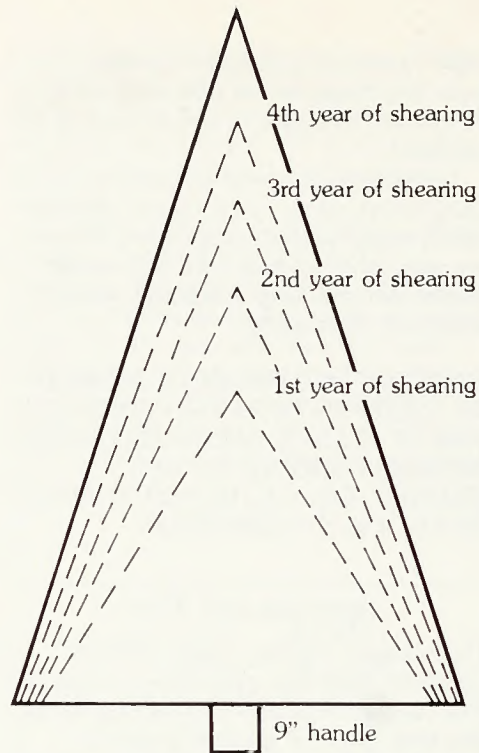


Fig. 22. Bottom limbs are not as vigorous as the limbs in the upper parts of the tree. These limbs should be allowed to develop with only enough shearing to produce more buds for compactness. Basal pruning should remove the weak limbs.

cal. Most properly formulated herbicides are shortlived in the environment but must be carefully used to prevent long-lasting effects by changing the composition of the plant community.

Reduction of target species by chemicals



Fig. 23. When cutting spruces or firs, use a very sharp knife to cut close to bud chosen as probable new leader.

may encourage the encroachment of another unwanted species. Competing plants may be reduced by the timely application of herbicides in sufficient dosage to accelerate the growth of the trees in the treated area. In some instances, two chemicals may be combined for a broader range of control.

To the extent that it allows best development of the crop, the control of competing vegetation is not a simple matter.

New chemicals, now being tested, will be introduced later. Contact your county extension agent for the latest recommendations.

Harvesting

Trees grow at different rates, so harvesting a plantation takes from 1 to 3 years.

Two harvesting methods may be used:

1. The grower cuts and markets the entire crop in one year. It is usually necessary to let trees grow an extra year or two to allow most of the trees to reach marketable size. Trees too small for marketing are either cut into boughs or destroyed. The advantage of this method is the low cost of harvesting and clearing the area for replanting the following spring.

2. The second method is to harvest on an area as the trees reach merchantable size. This method produces a greater yield of trees per acre, but the increases in harvesting costs may offset the profits from the increased yield.

Trees should be cut with a sharp saw at right angles to the stem to leave a flat base. The person responsible for designating the trees to be cut should know market specifications such as height, straightness of stem, length of handle, symmetry, and fullness of foliage.

The trees should be carried (not dragged) to a specified packaging and loading area. Twine or a plastic netting may be used effectively to bundle trees. Packaging trees can be done by a specified baling machine or by using a simple cone through which trees can be pulled to constrict them for tying. Packaging trees reduces damage during handling and shipping. Trees should then be hauled to the nearest truck-loading point and sorted

according to species, height, and quality as they are unloaded. Preliminary sorting reduces "wear and tear" of the trees when buyers want to inspect their trees at the loading point.

When trees are cut in advance of shipping dates, by all means protect them from direct sun and drying winds during the waiting period.

Growers of large acreages may find it

profitable to hire additional labor at harvest time for simultaneous cutting and loading out. While this practice increases handling costs, it would not delay truckers waiting for the trees.

Marketing

The market place is where the grower learns whether the money and effort he has expended to produce quality trees is enough to allow him to compete profitably against imported and wild-grown trees.

The North Carolina Christmas tree industry has depended on satisfied customers. *The future growth of the industry rests on the continuing demand for quality trees by satisfied customers. Do not expect retailers to accept cull trees.*

Marketing methods vary according to the size of operations and the buyers' demands for quality and other services.

A grower's reputation for selling quality trees year after year will relieve the buyers of having to inspect the trees at the plantation. This reputation will facilitate marketing and help keep satisfied customers.

The grower should label the trees accurately according to species, height, and general quality in terms of color, density, and shape. This procedure helps to build a good seller-buyer relationship. A brochure listing salable trees sent to all prospective buyers can help to increase sales. Such a brochure should include the species, size, quality, selling method (on the stump, at roadside, or delivered), and expected price. Growers may help sales by including pictures of their overall plantations and individual trees.

Many growers cut and harvest their own trees, but in some instances they may tag their trees and let the buyers do the cutting. It is usually better for the grower to cut and harvest to prevent high grading and

damage to the plantation.

When cutting many trees for specific buyers, it would be advisable to have a performance contract signed by both the buyer and seller. Usual terms call for a one-third payment when the contract is signed and the balance when the trees are picked up.

Growers of larger acreages are obliged to move thousands of trees, so production costs per tree may be less than for those producing smaller numbers of trees. Those growing fewer trees may sell either at the plantation or deliver trees directly to the local retailer.

Some growers operate their own lot and retail their own trees. Those selling fewer trees may offer additional services such as letting a buyer select and cut his own trees and making sales on consignment. Thus, he takes part of the marketing risk. By offering these additional services, the grower can expect a better net price per tree.

Some growers who live near population centers may sell trees directly to consumers in the plantation. If you choose this method you will need to have adequate all-weather parking in an accessible area within close driving distance of the city. Signs should be strategically located to direct customers to the plantation without difficulty. Thieves may also follow these directions, so be aware of the need for security of your trees. Good results may be obtained by advertising the location of the plantation and hours of operation. The customer should be provided with tools to

cut his choice from two or three species of trees on several acres. The grower should carry liability insurance.

There is considerable risk in retailing Christmas trees. The retailer's margin need not be so high if the grower assumes part of the risk. He may absorb all or a part of the loss on unsold Christmas trees. He may also deliver trees as the retailer needs them. This decreases the possibility of having large numbers of cut trees on hand after Christmas.

To realize a fair return, growers with small areas may compete with those having larger acreages by improving efficiency of operations and offering a better quality product. They may also compete with those offering larger volumes by combining sales of trees with other growers.

United States Department of Agriculture standard grades for Christmas trees may be used as a guide in grading trees for sale. If both grower and buyer know these standard grades and accept them, they can make tree sales by phone or letter without "on the ground" inspection.

Growers and buyers would find useful fellowship in an association of Christmas-tree growers. Many production and sales techniques are revealed in contacts with growers at their regular association meetings. Much helpful information can be found in the association's periodic news letter and the quarterly *American Christmas Tree Journal*.

Keeping Your Records

Keep complete documented records on your Christmas tree plantation from the beginning. Good records should include a map of the farm layout with reference points, scale and date. Information on the map may be anything useful for management such as information on

designation and size of fields, topography and surface drainage, location of roads, species and number of trees in each field, and date planted.

Other records should include soil test data, weather conditions at the time of planting, pest and weed control efforts, and

detailed cost and return figures. You need to know how many trees survive transplant shock, mowing machine injury, or pest attacks. A continuous inventory of merchantable trees permits calculation of cost per tree or fertilizer and pest control chemicals needed and depletion

allowance. Records should contain information detailed enough to permit you to determine the weak points of your operation. They will also enable you to compare your costs with published standards.

Records would be useful to determine a cash basis needed to arrive at your capital gains in case of casualty losses, damage claims, sale of property, or a fair market value for estate tax purposes. Accurate records would indicate whether or not you made a profit and can prevent the payment of unnecessary taxes.

The table on opposite page is an example of part of the records needed and should be used only as a guide. Insert prices prevailing at any given time.

Assistance Available

The North Carolina Agricultural Extension Service serves as the educational arm of North Carolina State University and the United States Department of Agriculture. Through the University staff, area and county specialists will provide educational assistance, information and guidance to the grower of Christmas trees.

The North Carolina Division of Forest Resources is a service organization that provides planting stock and seedlings that may be grown as Christmas trees. Their foresters may also assist in offering management advice about the culture of Christmas trees as well as pest control. They also assist landowners with problems of fire control.

The Soil Conservation Service of the United States Department of Agriculture is responsible for developing and carrying out soil and water conservation programs. They will advise on site characteristics relative to soil and water, as well as adaptability of tree species. They can also advise on the location of ponds and offer a varied amount of engineering assistance in the development of water control and water resources, and access roads within the plantations.

Conclusions and Summary

In undertaking to grow Christmas trees as a business venture, the following points need to be given careful consideration.

Christmas-tree crops require intensive management to produce a quality product. Unless a prospective grower is prepared to invest capital and many hours of labor in necessary management, he would be better off not to try at all.

Selection and preparation of planting sites are of first importance. The topography, surface condition, elevation, exposure, internal drainage, and accessibility to roads should be carefully considered.

Select the right Christmas-tree species adapted to site conditions and those that have strong market appeal.

Select good planting stock, take care of the trees, and plant properly to insure maximum survival.

Among the necessary cultural practices is a good pest control program. Livestock and fire should be kept out of plantations.

Control competing weeds, grasses, and brush to insure rapid growth and well-formed trees.

Develop the desired shape of the trees by shaping and shearing at right time to improve quality and increase the likelihood of higher prices.

Use harvesting techniques adapted to a given situation to minimize damage.

Join an association of Christmas-tree growers.

For additional information, contact your local county extension agent or service forester.

For additional information on soils, contact the Soil Conservation Service.

Appendix

Suggested References

American Christmas Tree Journal, National Christmas Tree Growers' Association, Inc., Milwaukee, Wis.

Bakuzis, E. V. and Hansen, H. L. Balsam Fir, *Abies balsamea* (Linneus) Miller. Univ. of Minn. Press. 1965.

Brown, James H. Effect of Time of Summer Pruning on Bud Set, Limb Development, and Shoot Growth of Sheared Pines. W. Va. Agr. Exp. Sta. Bul. 498. 1964.

Hacskaylo, John. Use of Permanent Latex Dyes for Christmas Trees. Ohio. Agri. Exp. Sta. For. Dept. Series 46. 1960.

Janes, Ray L., Butcher, J. W., and Morofsky, W. F. Christmas Tree Insect Control. Mich. Agr. Ext. Bul. E-353. 1958.

N. C. Agr. Extension Service, Weeds of the Southern United States. C599, \$1.00

Minkler, Leon S., and Ryker, Russell A. Color, Form and Growth Variations in Eastern Redcedar. Journal of For. 57(5):347-349. 1959.

Polk, R. B. Characteristics of Good Christmas Trees. Univ. of Missouri Bul. 820. 1964.

Sowder, A. M. Christmas Trees, the Tradition and Trade. U.S.D.A., Forest Service, Agriculture Information Bulletin 94. 1966.

Spaulding, P. Diseases of Foreign Forest Trees Growing in the United States. U.S.D.A. Agriculture Handbook 139. 1958.

U. S. Department of Agriculture, Soil Conservation Service in cooperation with North Carolina Agriculture Experiment Station—County Soil Survey Reports.

U. S. Department of Agriculture. United States Standards for Grades of Christmas Trees. U.S.D.A. Agriculture Marketing Service. 38 F.R. 5252. 1973.

STATE LIBRARY OF NORTH CAROLINA



3 3091 00747 2434

Work sheet for estimating revenue, operating expenses, annual ownership expenses and net revenue per acre for producing Fraser fir Christmas trees over a nine-year period using recommended practices

Item	Description	Quantity & Unit	Price	Amount	Per Tree
Gross revenue:	Trees cut 7th year, 6'-7'	580 ea.	_____	_____	_____
	Trees cut 8th year, 7'-8'	675 ea.	_____	_____	_____
	Trees cut 9th year, 8'+	287 ea.	_____	_____	_____
	Boughs ¹	200 ea.	_____	_____	_____
	Total			_____	
Establishment expenses:					
Labor	Apply herbicide (hand sprayer) ²	6 hr.	_____	_____	_____
	Spread lime and fertilizer (hand) ³	8 hr.	_____	_____	_____
	Site preparation	2 hr.	_____	_____	_____
	Set out trees (hand)	30 hr.	_____	_____	_____
Materials	Lime	0.45 ton	_____	_____	_____
	Fertilizer (phosphate)	5 cwt.	_____	_____	_____
	Herbicide	1 ac.	_____	_____	_____
	Premium planting stock ⁴	1742 ea.	_____	_____	_____
Equipment operating expense	½-ton truck	2 hr.	_____	_____	_____
	Tractor 30-39 h.p.	2 hr.	_____	_____	_____
	Disk	1 hr.	_____	_____	_____
	Harrow	1 hr.	_____	_____	_____
	Total establishment expenses			_____	
Maintenance expenses 2nd through 9th year:					
Labor	Replant trees	2 hr.	_____	_____	_____
	Apply herbicides (hand sprayer)	54 hr.	_____	_____	_____
	Apply pesticides	6 hr.	_____	_____	_____
	Apply fertilizer (annually if needed)	61 hr.	_____	_____	_____
	Mow (3 times per year)	106 hr.	_____	_____	_____
	Shearing and pruning	127 hr.	_____	_____	_____
	Spray pesticides (custom helicopter)	6 app.	_____	_____	_____
	Marking trees for sale	2 hr.	_____	_____	_____
Materials	Pesticides			_____	_____
	Herbicides			_____	_____
	Fertilizer	24.1 cwt.	_____	_____	_____
	Planting stock (replanting)	0.13 ea.	_____	_____	_____
Equipment operating expense	½-ton truck	18 hr.	_____	_____	_____
	Mower	106 hr.	_____	_____	_____
Roads and fire lanes				_____	_____
Christmas Tree Association dues ⁵				_____	_____
	Total operating expenses (not including labor or interest)			_____	_____
Net revenue over operating expenses				_____	_____
Value of labor				_____	_____
Net revenue to capital land and management				_____	_____
Total annual ownership expenses				_____	_____
Net revenue to land and management				_____	_____
Charge for land				_____	_____
Net revenue to management				_____	_____

¹ Boughs are those from pruning bottom limbs and from unmarketable trees.

² See Agricultural and Chemicals Manual for recommended herbicides and pesticides.

³ Fertilizer rates should be applied according to soil test recommendations.

⁴ Some growers may use collected wild seedlings or stock.

⁵ Prorated over 5 acres.

